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Weed Control in Lawns and Other Turf

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Common, Chemical Names of Herbicides and Some Trademark Names

Common Name	Chemical Name	Trademark name(s)[1]
amitrole	3-amino-*s*-triazole	AMINO TRIAZOLE WEED KILLER, AMITROL-T, CYTROL, WEEDAZOL
asulam	methyl sulfanilylcarbamate	ASULOX
atrazine	2-chloro-4-(ethylamino)-6-(isopropyl-amino)-*s*-triazine	AATREX G
benefin	*N*-butyl-*N*-ethyl-$\alpha.\alpha,\alpha$-trifluoro-2-6-dinitro-*p*-toluidine	BALAN
bensulide	*O,O*-diisopropyl phosphorodithioate *S*-ester with *N*-(2-mercaptoethyl) benzenesulfonamide	BETSAN, PRESAN, LESCOSAN, BETAMEC
bentazon	3-isopropyl-1*H*-2,1,3-benzothiadizain-4(3*H*)-one 2,2-dioxide	BASAGRAN
bromoxynil	3,5-dibromo-4-hydroxybenzonitrile	BROMINAL, BUCTRIL
2,4-D	(2,4-dichlorophenoxy)acetic acid	Too numerous to list
dalapon	2,2-dichloropropionic acid	DOWPON, RADAPON
DCPA	dimethyl tetrachloroterephthalate	DACTHAL
dicamba	3,6-dichloro-*o*-anisic acid	BANVEL
dichlorprop (2,4-DP)	2-(2,4-dichlorophenoxy)propionic acid	WEEDONE DP (also contains 2,4-D), WEEDONE 20
DSMA, MSMA, MAMA, CMA	methanearsonates	DACONATE, DSMA Liquid, WEED-E-RAD, CRAB-E-RAD, WEED-HOE
glyphosate	*N*-(phosphonomethyl)glycine	KLEENUP, ROUNDUP
mecoprop (MCPP)	2-[(4-chloro-*o*-tolyl)oxy]propionic acid	ISO-CORNOX 64; CHIPCO TURF MCPP; MECOPEX
metham	sodium methyldithiocarbamate	VAPAM, VPM
methyl bromide	bromomethane	Too numerous to list
oxadiazon	2-*tert*-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one	CHIPCO RONSTAR G
pronamide	3,5-dichloro-*N*-(1,1-dimetyl-2-propynyl)benzamide	KERB
siduron	1-(2-methylcyclohexyl)-3-phenylurea	TUPERSAN

[1]*List may be incomplete. Inclusion of trademarked names is for information only and no recommendation to the exclusion of others is intended.*

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Weed Control in Lawns and Other Turf[1]

The best defense against weeds is dense, vigorously growing turfgrass. Weeds have difficulty in gaining a foothold in such a lawn. To produce this kind of turf, you must select the best varieties of adapted grass species; grow them in good soil; maintain the correct soil acidity; use the proper fertilizer for your growing conditions; water the turf properly; use the correct growing procedure; and control weeds, insects, diseases, and nematodes. In spite of these efforts, weeds often become problems. Weeds may appear if the turf is mechanically disturbed; if the turf is worn by excessive use; and if diseases, insects, or droughts partially reduce the stand. Furthermore, some weed species are particularly strong competitors.

When weeds occur in lawns there are many methods of control, including use of cultural practices and herbicides. Herbicides are available for control of most of the weeds found in lawns and turf. If they are used according to directions on the label, the recommended herbicides will not damage plants and the hazard is low to the user, other persons, pets, birds, and wildlife in the area. Always read the directions and precautions on the label of herbicides before use. If improper cultural practices are the cause of thin, weedy turf, correct these basic causes as the first step in weed control.

Cultural Practices to Control Weeds

Fertilizing The nutrient most often lacking in turf is nitrogen. It and the two other more common fertilizer elements, phosphorus and potassium, should be in good supply when turf species are making most rapid growth. Several States recommend ratios of high nitrogen, low phosphorus, and medium potassium for repeat use on turf. Consult local experts about practices to be followed.

In the northern temperate climate, cool-season grasses should be fertilized more heavily in the fall, with a lighter application or none at

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all in early spring. Use of nitrogen in summer is less common. Annual rates of nitrogen range from 2 to 6 lb/1,000 square feet. Nitrogen levels in the soil should be declining in cool-season grass turf before periods of expected hot or dry weather.

Fertilize warm-season grasses such as bermudagrass, zoysia, and St. Augustinegrass with nitrogen during the spring, early summer, and early fall months at an annual rate of 5 to 10 lb/1,000 sq. ft.

Liming A pH in the range of 6.0 to 7.0 is considered best for turfgrass growth because it provides for more favorable nutrient availability and microbial activity. Ground agricultural limestone is frequently needed in acidic soils in the Eastern United States. Need for lime can be determined by soil test. As a generalization in higher rainfall regions, acid sandy soils usually require light applications (about 100 lb/1,000 sq. ft.) of ground or pulverized limestone every 2 or 3 years and clay soils require heavier applications (about 200 lb/1,000 sq. ft.) every 5 to 6 years. Lime can be applied at any season; however, late fall or winter is the best time.

Watering Sandy soils, because of their low moisture-retaining capacity, require frequent watering. Clay soils require less frequent watering but larger amounts of water. Do not water the lawn until grass shows signs of wilt. Then apply enough water, usually about an inch, to wet the soil 6 inches deep or more. Do not apply water faster than it can be taken in by the soil. Avoid watering lightly at frequent intervals; this is wasteful and causes shallow growth of grass roots and stimulates germination and growth of weeds. For instance, light, frequent irrigation encourages the invasion of annual bluegrass and crabgrass.

Mowing Mow lawns of most cool-season grasses at least weekly to a height of 2 to 2-1/2 inches. Close mowing, especially in hot weather, weakens cool-season turfgrasses and invites weed invasion. Crabgrass, in particular, can be reduced by the shading effects of the taller, denser growth of permanent grasses on the crabgrass seedlings. Invasion of spotted spurge, another warm-season weed, can be reduced by high mowing.

Warm-season grasses, particularly bermudagrass, require closer mowing than most cool-season grasses. Bermudagrass should be cut frequently to a height of 5/8 inch or less. Others such as zoysia, centipedegrass, and carpetgrass should be mowed to a height of about 1 inch. St. Augustinegrass and bahiagrass should be cut at 2-1/2 to 3-1/2 inches.

Mow lawns frequently. Keep the mower blades sharp. Unless growth is excessive and there are weeds setting seed in the lawn, leave the clippings on the grass. A mower with a mulching blade increases rate of decomposition of the clippings. Do not let grass grow unusually high. No more than one-third the length of the grass leaf should be removed at a clipping. If a lawn is to be mowed at 2 inches, the grass should be mowed before it exceeds 3 inches in height.

Timing of Cultural Operations In some turf areas, cultural operations require aerating, verticutting, or dethatching to enhance growing conditions. When planning these operations they should be timed to be performed when the turf will regenerate quickly. At the same time these operations should not uncover the soil or leave it bare at the time of year when seeds of crabgrass, annual bluegrass, or goosegrass germinate. These weeds invade rapidly into open areas.

These management operations should not be performed following preemergence herbicide applications or the weeds will not be controlled. If the preemergence herbicide bensulide or benefin is applied immediately after verticutting or dethatching, the grass regrowth may be suppressed.

Selective Weed Control

Selective herbicides are chemicals that will control most weeds without injuring the turfgrass. Use herbicides only when necessary and as part of a complete lawn management program. Always read and follow the directions on the label. An excess dosage of almost any herbicide will damage lawn grasses, and a herbicide may kill one weed and not affect others. To control some weeds you may need to use herbicides that will temporarily or even permanently injure lawn grasses.

Buying Herbicides Herbicides are sold in liquid, powder, and granular form. Most of them have common names that are assigned specifically to their chemical names. On the inside front cover of this publication, herbicides used for turf weed problems are listed. Because of the great number of trade names under which these herbicides are sold, the common names are used in the text of this publication.

The strength of liquid forms of herbicides may be stated on labels as pounds-per-gallon acid equivalent and percent of active ingredients. The weed-killing strength of other herbicides is stated on the label as percent of active ingredient. Labels on granular herbicides

state the percent of active ingredient and may give the size of lawn area to be treated with the package contents.

Herbicide Application Granular herbicides are ready to use as purchased. Granular herbicide particles are usually relatively large and drift less than liquid sprays. Granular materials are best applied with either the drop- or spinner-type spreader. Use the spreader setting recommended by the manufacturer or that listed on the herbicide label.

Extra precautions should be taken in applying fertilizer-herbicide mixtures. Do not overtreat by making a second or third trip around trees and shrubs to give them an extra feeding of fertilizer. Such extra trips can apply too much herbicide and cause injury or death to the trees and shrubs. Do not use the fertilizer-herbicide mixture each time the grass needs fertilizer.

Add liquid and wettable powder formulations to water and apply as a spray. Use a sprayer that can be adjusted to make a coarse spray at low pressure (less than 35 psi). On very small areas you may use a garden sprinkling can. Care must be taken in handling sprays, especially herbicides such as 2,4-D, dichlorprop, mecoprop, and dicamba. Drift of even small amounts of these can damage trees, shrubs, flowers, and vegetables. Make treatments only when there is little or no wind. Usually 1 to 5 gallons of spray mixture per 1,000 sq. ft. of lawn are used. Within these limits the volume of spray used is not important. It is extremely important, however, to use the proper dosage of herbicide per 1,000 sq. ft.

The most convenient equipment for applying sprays to small areas is the pressure or knapsack sprayer of 1- to 3-gallon capacity. This type of sprayer provides a fairly consistent volume of spray at low pressure and allows you good control in limiting spray to the target area. Constant container agitation is necessary when using the wettable powder or emulsifiable formulations or they will settle out.

One method of treating small patches or individual weeds is to use a small paint brush or sponge nailed or wired to a broomstick or dowel. Mix a small amount of herbicide in a container that has a large enough opening so that the sponge or brush can be easily dipped. After dipping, squeeze out the excess by pressing the brush or sponge against the inside of the container. Simply "paint" or dab the weed. Also, such commercial devices are available on the market. When using this method, dilute the herbicide as if it were to be sprayed. Do not use full strength chemicals or turf injury will result.

Do not spray other plants such as flowers or vegetables with equipment that has been used for herbicides. There may be enough herbicide spray residue left in the sprayer to cause injury to these plants.

Herbicide Treatments and Weed Types

Most lawn weeds are classed either as grasses or as broadleaf types. The annual grass type includes crabgrass, foxtails, and barnyard grass. Examples of broadleaf types include dandelions, plantains, and chickweed. A narrow-leaf weed that is not a grass is nutsedge. Each type requires different herbicides for effective control.

Herbicides used for crabgrass are usually effective on most other annual grasses. The herbicides effective for controlling dandelion, plantain, and chickweed are usually effective on most of the other broadleaf weeds (see table and drawings at the back).

There are three types of weed control treatment:

- Preplanting - a herbicide applied before seeding or sodding turf.
- Preemergence treatment - the herbicide applied before weed seeds germinate.
- Postemergence treatment - the herbicide applied after weeds emerge. Sometimes, a sequence of treatment at definite intervals or repeated treatments are required to kill weeds without excessive injury to the turf.

Always read instructions on the label and pay particular attention to limitations on use.

Control of Weed Grasses Crabgrasses and other annual summer grasses may be a problem in lawns in most areas of the United States. You can achieve best control from one of the preemergence herbicides applied before seed germination. A good index as to best time for application is when *Forsythia* is flowering or when lilacs are about to bloom. Another useful index is when soil temperature reaches 50°F. In most warm- and cool-season turfgrasses DCPA, benefin, bensulide, siduron, and oxadiazon applied before weed seed germinates, and according to directions, provide control. Only siduron can be used on newly seeded turf areas. Other materials have a specified waiting period (2 months or more) before overseeding is recommended. If no rainfall is received within 3 or 4 days after treatment, sprinkle irrigation is recommended.

DCPA may injure red fescue and dichondra. Benefin may injure bentgrass and dichondra. Bensulide may be used on most turf species. Oxadiazon should not be used on bentgrass, centipedegrass, dichon-

dra, or zoysia; in some areas it will injure perennial ryegrass. Siduron is not recommended for use on bermudagrass and some varieties of bentgrass.

Some of the other weedy annual summer grasses that may be controlled with these herbicides include barnyardgrass, fall panicum, foxtails, and goosegrass. Goosegrass is usually the most difficult to control.

For control of such weeds as crabgrass, *Paspalum* sp., spotted spurge, and most other annual broadleaf weeds in centipede, St. Augustine, and zoysia grasses, apply the granular formulation of atrazine in January, February, or March before weeds germinate. Treat soon after planting newly sprigged lawns to reduce competition from weeds. Do not apply to root zone areas of trees and shrubs.

Postemergence use of methanearsonate herbicides (DSMA, MSMA, CMA, and MAMA), in two to three treatments of 5- to 10-day intervals, provides some control of seedling and juvenile plants of crabgrasses, foxtails, sandbur, and other annual summer grasses. To be effective and to minimize turf injury, soils should have enough moisture to support active growth. Also, treatments should be made on days when temperatures will not exceed 85°F. Even so, some temporary discoloration of turf is common. Generally, preemergence herbicides are more reliable for controlling crabgrass.

Asulam is used for postemergnce control of annual grasses and certain broadleaf weeds in St. Augustinegrass only. Atrazine will also control certain broadleaf and grass weeds when applied either preemergence or postemergence in St. Augustinegrass.

Goosegrass tends to be a problem where soils are compacted and turf is thin. It is an annual whose seeds germinate later than crabgrass in spring and during the summer. Herbicide treatments used for crabgrass control should be reinforced by a second application of one-third to one-half the initial rate 4 to 5 weeks after the first application to provide better goosegrass control. Most of the herbicides give variable results. Oxadiazon tends to provide more reliable results than the others. It may be best to correct the causes of the problem, and reseed or sod in the fall to allow time for dense turf to develop before the next spring.

Annual bluegrass tends to be a major problem in closely mowed turf (such as putting greens) and in thin stands or along turf borders. It is a cool-season species whose seeds can germinate throughout the year except in the Deep South. Most preemergence herbicides used in cool-season turfgrasses give only partial control. In some areas bensulide is the preferred herbicide. Good turf management practices (infrequent irrigation and high mowing height) may limit infestation.

Annual bluegrass can be well controlled in bermudagrass in the Southeastern States by pronamide either as a preemergence or postemergence treatment. Do not overseed treated areas for 90 days after application of pronamide, unless finely ground charcoal is applied before seeding.

Bermudagrass, quackgrass, zoysiagrass, kikuyugrass, nimblewill, and other perennial grasses that spread by horizontal stems, either below or above ground, are often weeds in cool-season turfgrass and can be controlled by methods to be discussed under turf renovation. Glyphosate is advantageous for spot treatments. Such spreading perennial grasses often have dormant buds at the joints of the spreading stems that may not be killed by a single treatment of herbicide. When practical, a second application with 1 to 2 months between treatments increases the chance of eradicating these species. Continue to search for any live plants for many months or years after treatment. Because glyphosate is effective only when applied to leaves, an abundance of foliage on the weed grasses at the time of application is necessary for control. Treated spots can be seeded, sprigged, or sodded soon after treatment as discussed under "Renovation," page 13. Any reinfestation should be spot-treated as soon as observed.

Tall fescue, timothy, orchardgrass, and other such perennial bunch grasses, when in fine turf, give a clumpy appearance because of their more rapid growth. If only a few clumps occur they can be removed by cutting under them shallowly with a spade. The bunch grasses can be spot sprayed. The bare spots can be resodded or filled with topsoil and seeded. See renovation treatments.

Dallisgrass and some other *Paspalum* species are controlled by repeated applications of postemergence sprays with DSMA and other methanearsonate herbicides at the highest rate recommended on the label. Some slight discoloration of turf may result temporarily. Do not use on St. Augustine, bahiagrass, carpetgrass, or centipedegrass turf.

Control of Broadleaf Weeds Broadleaf weed control herbicides are usually applied directly to foliage and stems of actively growing weeds (postemergence treatments). Most should be applied in early fall (to allow grass to fill spaces left by dead weeds) or in the spring.

Most broadleaf weeds are controlled by using one of the commercially available products containing 2,4-D in combination with one or more of the following: Dicamba, mecoprop, and dichlorprop.

There are only a few broadleaf weeds that will not be controlled by these combinations. In newly seeded turf bromoxynil will control many seedling broadleaf weeds. For weeds not controlled by these herbicides, you may consult your local County Extension agent or garden center representative for specific recommendations. Responses of some common weeds to herbicides are given in the table on pages 16 and 17. Do not mow or water lawn for at least 2 days after treatment.

If you use a granular material, be sure to follow instructions on the label. It is generally recommended that such formulations be applied when plant leaves are moist by dew in early morning or just *after* watering the lawn. Herbicide granules retained in water droplets on the leaves are readily absorbed by the leaves.

A high percentage of lawn weeds are controlled by 2,4-D. However, several common weeds are not controlled by it. Included in this group are a number of weeds that are well controlled by dicamba (knotweeds, red sorrel, white clover, henbit, chickweeds, and many others).

Take special care not to exceed recommended rates with dicamba because it may be absorbed from the soil by plant roots of ornamentals in amounts injurious to shrubs and some trees. For safety, do not treat within the "drip line" of shrubs and trees.

Speedwells and prostrate spurge are not well controlled with 2,4-D and herbicides commonly sold in mixtures with it except where plants are quite young. These weeds can be suppressed by sprays of DCPA applied at about the same time they should be applied for crabgrass control. Bromoxynil applied postemergence on young spurge will further reduce populations.

Yellow nutsedge is a perennial that reproduces mainly by nutlets underground that may persist in the dormant stage. If you have only a few plants, persistently pull the plants before each mowing date to control them. Heavier stands are controlled with difficulty and often incompletely. Two or three treatments with bentazon, DSMA, or other methanearsonates in late June and July, with 7- to 14-day intervals between treatments, will reduce stands of yellow nutsedge. Repeated heavy treatments with 2,4-D will also reduce stands of yellow nutsedge. Temporary slight discloration of lawn may result.

Wild garlic produces hardshell bulbs that may lie dormant underground and may continue to produce plants for about 3 years. There-

fore, to control this species use three annual treatments with 2,4-D made in late winter or very early spring at the highest rates recommended on the label. Low volatile ester formulations are more effective than amine salts.

Tillage and New Seedlings or Plantings

Tillage and Turf Establishment Existing turf can be removed by a sod cutter, or in small areas, with a flat shovel. Also, the areas can be cultivated with rotary-tillage equipment. Many weeds are easily killed by cultivating and drying. If time is available, fallowing the soil with cultivation intervals of 3 to 5 weeks will control many of the weeds arising from seeds and vegetative parts present in the soil. However, tillage is seldom adequate to control such pernicious perennial species as quackgrass, bermudagrass, zoysia, and nutsedge. Use one of the herbicides, discussed under "Renovation," that has little or no residual toxicity in the soil before tillage when renovating such areas; or use a soil fumigant after tillage. Finally, add needed lime and fertilizer and plant seed in a smooth, firm seedbed. High-quality seed of an adapted turf variety may be broadcast on the surface and raked in or seed may be shallow drilled. It may be advantageous to cover the surface lightly with a straw mulch, peat, or compost. If you broadcast seed on the soil surface, wet the seed and soil (sprinkle irrigate) daily for 7 to 14 days until seedling plants are visible. Then water less frequently.

Control of Weeds Some weeds in new seedings can be partially controlled by a proper balance of mowing, irrigation, and fertilization. If seedling broadleaf weeds threaten to shade out turfgrass seedlings, even after one or two mowings, they may be controlled by herbicides. A mixture of 2,4-D with other herbicides can be used advantageously on cool-season grass seedlings of such species as Kentucky bluegrass, red fescue, and tall fescue if applied at one-quarter to one-third the rate used in established turf. Such treatments should be delayed 5 weeks or more after seeding. Also, bromoxynil alone or in combination with dicamba has effectively controlled many annual broadleaf weeds in new seedings without any delay in use needed after seeding.

In spring or early summer seedings, crabgrass, foxtail, or bermudagrass plants can be controlled by an application of siduron made on cool-season turf species at seeding time.

Soil Fumigation Soil fumigation before seeding or planting the turf species is a very effective method of controlling persistent weeds if used on moist, tilled soil.

- *Metham* is a soil fumigant used to kill germinating seeds, rhizomes, tubers, roots, and stems of weeds in soil.

The soil should be cultivated and kept moist for a week before applying metham. Then treat with 1 to 2 pints of commercial formulation in a sprinkling can to each 100 sq. ft. of soil using 2 to 5 gallons of water. Immediately sprinkle the treated area with water until soil is wet as deep as control is desired. To increase effectiveness, an airtight cover may be spread over treated area (cover edges with soil) to substitute for the water seal. This greatly increases the effectiveness of the fumigant as a herbicide. You may seed 14 to 21 days after treatment.

- *Methyl bromide* is a restricted fumigant herbicide that is very poisonous and may be used only by a certified applicator. It is particularly effective for control of pernicious weed species with nutlets, bulbs, corms, and lateral underground stems. It also kills most seeds and disease organisms in the soil. It does not control hard seeds of clover, dichondra, or field bindweed. Methyl bromide must be applied when soil temperature is above 60°F and under a well-sealed airtight cover. Because of the poisonous character of the gas, it can be safely used only if strict precautions are followed. You can remove the cover 2 days after treatment and seed 2 days later.

Turf Renovation and Spot Treatments

Sometimes an existing lawn that has weeds and mixed grass species needs to be changed into a turf of superior quality. For example, a Kentucky bluegrass turf may have been invaded by bentgrass, bermudagrass, zoysia, or quackgrass. These unwanted grass species cannot be controlled selectively in Kentucky bluegrass. Therefore, they must be killed before a new lawn is established. Renovation involves killing or removing the existing vegetation and establishing new turf.

Select the time of renovation that will favor establishment of the desired turf species (when you expect adequate rainfall to germinate seeds, especially if irrigation is not available, and when competing weeds will be least troublesome). You may need to seek local advice because conditions differ greatly among regions and for turfgrass species. Varieties of turf species should be those best adapted in the region. Under some situations, or with some turf species, sodding or

sprigging is preferable to seeding. Check with your County Extension agent for up-to-date information, especially about grass establishment techniques.

Herbicides for Renovation A number of herbicides will kill established vegetation and weeds. Some herbicides require no waiting period after treatment before seeding while others leave toxic residues requiring waiting periods of 20 to 50 days before seeding.

No seedbed tillage preparation is required when vegetation is killed by herbicides provided the seed of turf varieties are placed in contact with the mineral soil. The latter is important. A disk-seeder machine will accomplish this task in one pass. If excessive thatch is present, till, verticut, or thoroughly rake it with a thatch rake. Other information under "Tillage," page 12, also applies here. Because germinating weed seeds may present severe weed problems where limited tillage is practiced, supplemental weed control is often required.

- *Glyphosate* is used as a foliage spray and effectively controls grasses and broadleaf weeds. Plants should have well-developed foliage and be growing actively when sprayed. Glyphosate is translocated throughout the plant and the vegetation should not be mowed, verticut, or cultivated until 3 or more days after treatment. Glyphosate is water soluble and is partially washed off plants by rainfall or sprinkle irrigation within 6 hours of treatment.

Most cool-season grasses and annual grasses are killed by treatment with 1 pound acid equivalent per acre of glyphosate. Almost all plants of such strongly spreading grasses as bermudagrass are killed with a single spraying with glyphosate at 4 lb/acre under favorable conditions. In the Middle Atlantic States, two treatments, 1 to 2 months apart, at 1-1/2 to 2 lb/acre are slightly more effective on bermudagrass and zoysia. Moisture should be adequate to cause development of dormant buds between treatments. Also, to increase control in some areas, the turf can be verticut or cultivated 7 days after treatment and the area can be completely dried out to kill any remaining dormant buds.

You can seed turfgrasses soon after treatment with glyphosate because it leaves no residues in the soil toxic to germinating grass seeds. Glyphosate does not move laterally in runoff water from the treated area. Prevent sprays or drift from contacting foliage of desirable plants or injury will result.

Use control methods described earlier for weeds that may become a problem in the new seeding.

- *Amitrole* is a foliage-applied, translocated herbicide that will control most annual species and some perennial grass species. Best

control is achieved if weeds are growing vigorously in moist soil. If it does not rain within 5 to 7 days after treatment, apply heavy irrigation. Ten to fourteen days after treatment (when grass or weeds are white or brown) the area should be cultivated. This can be done by digging, rototilling, or otherwise loosening and drying treated areas—verticutting, aerating, or raking the area is not enough. If rain or watering occurs within 12 hours after treatment, reduced control will result. If bermudagrass regrows, it should be 2 to 3 inches high before retreating. Rototill the area again in 10 days and then seed.

- *Dalapon* is used for turf renovation in Arizona and California only. Mow any dead vegetation present, irrigate, and wait 2 weeks for new grass growth, then spray with 0.37 oz active ingredient per 1,000 sq. ft. (1 lb/acre). After 2 to 3 weeks, water at least 15 min/day for 1 week. Wait 4 to 6 weeks, then seed, plug, or sprig new lawn.

Verticutting or rototilling, followed by drying of soil, will increase control of bermudagrass and other perennial grasses.

Runoff water can carry dalapon to adjoining turf areas and cause injury.

Spot Infestations Often a spot(s) of coarse grass such as tall fescue in Kentucky bluegrass or pernicous perennials such as bermudagrass, bentgrass, quackgrass, nimblewill, and others will occur in otherwise high-quality turf. These cannot be killed selectively. Methods discussed under "Renovation," particularly glyphosate, can be used to kill these spots so that they can be reseeded, sodded, plugged, or sprigged. Be particularly careful to confine the spray to the spot intended to be sprayed. For such weed species as bermudagrass, the sprayed area should extend at least 12 inches beyond the last observed bermudagrass plants because of their strong rhizome habit that grows outwardly. Do not use dalapon for spot treatments because runoff water carries the herbicide outside the treated spots to adjoining turf and kills more grass than intended.

Equivalents

1 quart = 2 pints = 4 cups = 32 fluid ounces = 946 milliliters

1 cup = 8 fluid ounces = 16 tablespoons = 237 milliliters

1 fluid ounce = 2 tablespoons = 29.6 milliliters

1 pound = 16 ounces = 454 grams

1 acre = 43,560 square feet = 0.405 hectare (ha)

1 hectare = 2.47 acres

Response of Lawn Weeds to Herbicides[1]

(Symbols: E = excellent, VG = very good, G = good, F = fair, and P = poor)

Weed	Type of plant	Control[1]			
		2,4-D	MCPA	dicamba	mecoprop
Bindweed, field *Convolvulus arvensis*	Perennial	G	F	F	G
Buttercup, creeping *Ranunculus repens*	Perennial	G	E	G	G
Chickweed, common *Stellaria media*	Annual	G	F	E	E
Chickweed, mouseear *Cerastium vulgatum*	Perennial	F	F	E	G
Cinquefoil, Canada *Potentilla canadensis*	Perennial	VG	G	E	—
Cinquefoil, sulphur *P. recta*	Perennial	VG	G	E	—
Clover, White *Trifolium repens*	Perennial	P	P	E	VG
Clover, bur *Medicago polymorpha*	Annual	F	F	E	E
Daisy, English *Bellis perennis*	Perennial	P	P	E	F
Dandelion *Taraxacum officinale*	Perennial	E	E	F	F
Dock, curly *Rumex crispus*	Perennial	VG	G	VG	F
Garlic, wild *Allium vineale*	Perennial	G	F	F	—
Ground ivy *Glecoma hederacea*	Perennial	G	F	G	—
Henbit *Lamium amplexicaule*	Annual	F	F	E	—
Ivy, English *Hedera helix*	Perennial	P	P	F	P
Knawel, annual *Scleranthus annuus*	Annual	P	P	E	—
Knotweed *Polygonum aviculare*	Annual	F	F	E	F
Medic, black *Medicago lupulina*	Annual	G	G	G	G
Moneywort *Lysimachia nummularia*	Perennial	E	—	—	—
Nutsedge, purple *Cyperus rotundus*	Perennial	F	P	P	P

Response of Lawn Weeds to Herbicides[1]—continued

(Symbols: E = excellent, VG = very good, G = good, F = fair, and P = poor)

Weed	Type of plant	Control[1]			
		2,4-D	MCPA	dicamba	mecoprop
Nutsedge, yellow *C. esculentus*	Perennial	F	P	P	P
Pennywort, lawn *Hydrocotyle rotundifolia*	Perennial	VG	—	E	—
Plantain, broadleaf *Plantago major*	Perennial	E	G	F	F
Plantain, buckhorn *P. lanceolata*	Perennial	E	G	F	F
Plantain, rugel *P. regelii*	Perennial	E	G	F	F
Posion Ivy *Toxicodendron radicans*	Woody	G	G	G	—
Posion Oak *T. diversiloba*	Woody	G	F	F	—
Puncturevine *Tribulus terrestris*	Annual	VG	F	E	—
Sorrel, red *Rumex acetosella*	Perennial	P	P	VG	P
Speedwell, corn *Veronica arvensis*	Annual	F	P	F	—
Speedwell, purslane *V. peregrina*	Annual	G	P	F	—
Spurge, spotted *Euphorbia maculata*	Annual	F	F	F	P
Strawberry, wild *Fragaria*	Perennial	F	P	G	—
Thistle, Canada *Cirsium arvense*	Perennial	G	G	E	—
Violet *Viola*	Perennial	F	P	F	—
Woodsorrel, yellow *Oxalis stricta*	Perennial	F	P	F	P
Woodsorrel, creeping *O. corniculata*	Perennial	P	P	P	P

[1]The effectiveness evaluations are given as general susceptibility of the weed to a herbicide. For further information consult individual labels and local authorities. Further research may result in change in some of the current effectiveness ratings. A dash indicates effectiveness is not known.

Large Crabgrass

Large crabgrass, an annual, reproduces by seed. The stems are stout and vigorous; those that are prostrate root at the joints. Stems are not hairy. The leaf blade and the lower part of the leaf (sheath), which encloses the stem, are hairy on large crabgrass; leaves and sheaths on smooth crabgrass are hairless. Most leaf blades of large crabgrass are 1/4 to 1/3 inch wide. Smooth crabgrass is not as coarse and tall as large crabgrass. Seeds are borne on 3 to 10 branches that radiate from the top of upright stems. The two rows of seed are on opposite sides of the branch.

Smooth Crabgrass

Bermudagrass is an aggressive perennial grass that forms a dense, heavy sod. It reproduces by prostrate stems (both above and below ground) that root at the joints, and by seed. Below-ground stems are hard, scaly, and sharp pointed. Above-ground stems are gray green and most of their surface is hairless. There are long hairs at the edges just above the junction of the leaf blade and the sheath (the part of the leaf that encloses the stem). Bermudagrass often has two sheaths attached to a single joint. Seeds are borne on three to five branches that radiate from the end of a flattened stem; the two rows of seeds on each branch are pressed closely against one side of the branch.

Goosegrass

Goosegrass is an annual that reproduces by seed. In general appearance, it has some resemblance to crabgrass. Stems are prostrate and without hairs, like those of smooth crabgrass. Crabgrass stems root at the joints; goosegrass stems do not. The pale-green leaf blades usually are without hairs and are 3 to 12 inches long; they may be folded. Seeds are borne on 2 to 10 branches that radiate from near the top of the stem. There are two rows of seeds, both of which are on one side of the branch.

Dallisgrass

Dallisgrass is a perennial with short rhizomes that gives a clumped appearance in sparse stands. Stems are 18 to 60 inches tall and without hairs except at the ligules and on the crowded spikelets that are on one side of the rachis. Seeds are borne in 3 to 9 racemes per stem that are loosely ascending or spreading. It is found in the Atlantic Coast States, southward from New Jersey and Missouri, and across the southern border States.

Quackgrass

Quackgrass is a perennial noxious weed that reproduces by seed and spreading underground stems. New shoots and roots arise from joints on the underground stems. Aboveground stems, 18 to 36 inches tall, are smooth with three to six joints. Leaves have auricles, ligule 1/32 inch long, hairy lower sheath and upper sheaths without hair or nearly so. Leaf blades are soft, flat, with crowded fine ribs. Seeds are borne in a single spike per stem, with three to seven short-awned florets per spikelet. It is a noxious weed found throughout the United States except the southern area.

Nimblewill

Nimblewill, a perennial, reproduces by seed and by stems that root at the lower joints. Growth that develops from rooting stems forms dense patches 10 inches or more in diameter. The lower part of the stem is semiprostrate; upper parts curve upwards. The slender, branching stems are not hairy. Leaf blades are short, flat, and hairless. The stems that bear the seeds are branching and 2 to 6 inches long. Seeds are very fine and borne singly.

Barnyardgrass

Barnyardgrass is a summer annual that reproduces by seed and is a problem in new seedings. Stems are stout, erect to semiprostrate, often branching from the base, seldom more than 3 feet in height. It has no ligule or auricle. Leaf blades are hairless, elongate, and light green. The head is branched, erect to nodding, green to purplish tinged, and 4 to 8 inches long. It tolerates wet sites and is found throughout the Unted States except the extreme southeastern area.

Annual Foxtail Grasses

The Foxtails shown are summer annual grasses. They reproduce only by seed. Yellow foxtail (A) is the species most often found in newer lawns. In mowed lawns, yellow foxtail produces a mat of foliage and seed heads. The stem bases usually are flattened and reddish. The stems are usually 6 to 12 inches high. The leaves are flat but may have a spiral twist; they have long hairs where the leaf joins the leaf sheath enclosing the stem. The growing season is similar to that of crabgrass and control methods are the same for both weeds. Green foxtail (B) has round stems that branch at the base and are 10 to 20 inches high. Heads are erect to slightly nodding, densely flowered, usually green to purple colored, and tapers slightly toward the summit. Giant foxtail (C) is similar in many ways to green foxtail, except it is taller, the stem weaker and often lodged, the head is more lax and nodding, and the leaf blades often are softly hairy beneath. It is seldom a weed in lawns.

Field Sandbur

Field sandbur is a summer annual grass that reproduces by seed that are borne in burs in terminal spikes. It is troublesome in lawns, gardens, crops, and waste places mainly because the spiny burs cause discomfort to persons and animals. Stems are erect and often spreading and mat-like, 6 to 24 inches long. It is found mostly in sandy soils along the South Atlantic Coastal Plain from Virginia to Texas and westward from Arkansas to California.

Yellow Woodsorrel

Yellow woodsorrel, a perennial, reproduces by seed. It is a low-growing plant, 4 to 12 inches tall. The weak stems branch at the base and may root at the joints. Leaves are divided into three folded, heart-shaped leaflets that radiate from the end of a long, slender leaf stalk. Leaves are sour tasting. The yellow flowers have five petals and occur in clusters.

Yellow Nutsedge

Yellow nutsedge, incorrectly called nutgrass, is a grass-like perennial weed. It reproduces by seed and tubers on the underground lateral stems. Mature plants have nut-like tubers at the tips of the lateral stems. Above-ground stems grow erect and are triangular in cross section and yellowish-green in color. Looking down on the plant, the leaves appear in three ranks corresponding to the triangular stem rather than two ranks as in grasses. Nutsedge is found in lawns in low, wet areas and in lawns that are watered excessively in the summer.

Wild Garlic

Wild garlic is a perennial bulbous herb. It reproduces by bulbs, bulblets, and seed. The stem is stiff, erect, leafy to near the middle, and 12 to 50 inches tall. Leaves are 2-ranked, with sheathing bases, the leaf blades circular and hollow in cross section, striped, the younger ones easily flattened and slenderly tapering. Plants form four types of bulbs: aerial bulblets at end of upright stem, underground hard shell bulbs (dormant) that have a single bladeless storage leaf that contains a growing point at its base, central bulbs, and soft offset bulbs.

Prostrate Knotweed

Prostrate knotweed is a summer annual weed that reproduces by seed. Stems are 4 to 40 inches long, prostrate or loosely ascending, the main stem corrugated, much-branched, and mostly forming mats from thin taproots. Leaves are alternate, sharp-pointed to rounded at the end, narrowed at the base, blue-green, lanceolate, linear to oblong, 3/16 to 1 inch long and from 1/16 to 5/16 inch wide. It is found throughout the United States.

Spotted Spurge

Spotted spurge, also known as prostrate spurge, is a summer annual reproduced by seed. Stems are slender, prostrate or ascending, branching from near the base, forming mats 4 to 36 inches in diameter, soft, hairy, and often reddish, and have a milky juice. Leaves are opposite, 3/16 to 5/8 inch long, ovate to oblong in shape, and often purple-mottled in appearance. It is distributed throughout the Eastern and Central States, the Pacific Coast, and a few areas in Idaho and Arizona.

Common Chickweed

Mouseear Chickweed

Common chickweed and mouseear chickweed are similar in habit growth. Common chickweed is a low-spreading plant, and mouseear chickweed is partly spreading to erect. Leaves on both plants are small, single, and opposite each other on the stems. Flowers on both are small; the petals are white and fine. But there are distinct differences: (1) Leaves of common chickweed are broadly oval, pointed at the tip, not hairy, and are borne on short leaf stalks; leaves of mouseear chickweed are very hairy, more elongated than round, and attached directly to the stem. (2) Flower petals are slightly notched on mouseear chickweed, and deeply notched on common chickweed. Common chickweed is an annual or winter annual that reproduces by seed and by creeping stems that root at the joints. Mouseear chickweed is a perennial that normally reproduces by seed; occasionally, it reproduces by root development on lower branches.

Ground ivy, a perennial, reproduces by seed and by creeping stems. Stems that are prostrate root at the joints; those that are upright give rise to long leaf stalks. Stems have four sides. The bright green leaves are almost round with round-toothed edges, and ½ to 1½ inches in diameter. Flowers are small, bluish purple, funnel shaped, and borne in small clusters in the axils of the leaves.

Henbit

Henbit is a winter annual that reproduces by seed and, occasionally, by rooting at the joints where stems touch the ground. Stems are 4 to 6 inches tall, slender, hairless, and four-sided. Leaves are oppostie each other on the stems, and are hairy with rounded teeth. Lower leaves are borne on leaf stalks; upper leaves are attached directly to the stem and clasp the stem. Flowers are pinkish to purple.

Purslane Speedwell

Purslane speedwell is a winter annual that reproduces by seed. Its root system is quite fibrous. The small, white flowers are located in the axils of the upper leaves. The seed pod is flat, heart shaped, and about 1/8 inch wide. The weed is noticed especially in early spring when bluegrass is just starting to grow well.

Common or Corn Speedwell

Common or corn speedwell is a winter annual that reproduces by seed. Its leaves are more oval than those of purslane speedwell and are notched on the margins. The flower petals are blue, and the whole plant is covered with tiny hairs. The heart-shaped seed capsule may be 1/4 inch wide. Like purslane speedwell, this weed is found growing in lawns in early spring when bluegrass is making vigorous growth.

Plantains

Buckhorn, broadleaf, and blackseed plantains commonly found in lawns are perennial plants that reproduce only by seed. All have erect, leafless stems that terminate with a flower spike. (A) Buckhorn plantain leaves are all basal in a rosette, the blades are slender, lanceolate, with 3 to 5 prominent veins tapering into the petiole. This weed is found throughout the United States with heaviest concentrations in the Middle Eastern States eastward from Nebraska and Kansas. (B) Broadleaf plantain has broadly ovate leaves, about 2 to 12 inches long, that form a rosette. The blades are thick, rough on one or both sides when dry, with minute hairs. The petioles are broad, usually green (no purple tinge), and hairy at the base. It is found throughout the United States. (C) Blackseed plantain has broadly elliptic to oval leaves, about 2 to 8 inches long, that form a basal rosette. The blade is simple, thin, pale, hairless to slightly hairy, usually wavy-edged, petiole is margined, at base usually hairless and tinged with purple. It is found in the eastern half of the United States.

Red Sorrell

Red sorrell is a perennial that reproduces by creeping rootstocks and seed. It gets its name from the reddish appearance of the seed head. The rootstocks are shallow. The leaves are 1 to 2 inches long, thick with smooth surface, and sour tasting. The weed is seen mostly in the spring and fall when it is cooler. It persists in areas of poor drainage and acid soil conditions.

Dandelion

Dandelion is a perennial herb from a thick taproot with many-branched crowns, with milky juice, and it reproduces by seed. Shallowly cut roots produce new shoots. Stem is very short and wholly underground, producing a rosette of leaves at the ground surface. Leaves vary in shape, from lobeless or entire to deep-cut lobes. Flowerheads are golden-yellow, 1 to 2 inches in diameter in flower, solitary at the end of a naked hollow stalk 2 to 30 inches long. It is found throughout most of the United States.

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